LBNL-41098
UC-1321

Primer on Electricity Futures and Other Derivatives

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January 1998

The work described in this study was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Utility Technologies, Office of Energy Management Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

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Abstract

Increased competition in bulk power and retail electricity markets is likely to lower electricity prices, but will also result in greater price volatility as the industry moves away from administratively determined, cost-based rates and encourages market-driven prices. Price volatility introduces new risks for generators, consumers, and marketers. Electricity futures and other derivatives can help each of these market participants manage, or hedge, price risks in a competitive electricity market. Futures contracts are legally binding and negotiable contracts that call for the future delivery of a commodity. In most cases, physical delivery does not take place, and the futures contract is closed by buying or selling a futures contract on or near the delivery date. Other electric rate derivatives include options, price swaps, basis swaps, and forward contracts. This report is intended as a primer for public utility commissioners and their staff on futures and other financial instruments used to manage price risks. The report also explores some of the difficult choices facing regulators as they attempt to develop policies in this area. Key findings include:

1. Hedging decisions are often made using sophisticated, proprietary computer models, and new hedging strategies and instruments are developed frequently. It is doubtful that state PUCs will have the time and expertise to reconstruct and dissect hedging decisions made by distribution utilities and others. As such, a performance target approach appears to be a much better policy than a reasonableness review.

2. PUCs should guard against speculation on the part of distribution utilities, even though it can be difficult to establish simple rules that can prevent speculative transactions. One possibility, however, is for regulators to require utilities to identify the obligations being hedged and report both the correlation between the obligation and the future contract, and the size of the hedge as a percentage of the purchased commodity being hedged.

3. Some PUCs have established program limitations and other protective measures for hedging instruments used by utilities and telecommunications companies to manage interest and exchange rate fluctuations. These measures, which may provide a guide to regulating utility involvement in electricity derivatives, have included: 1) requirements that utilities only enter into hedging agreement with entities with a credit rating equal to or better than the utility itself; 2) limitations on the amounts that can be hedged; 3) reporting requirements, including both income effects and expenses and the filing of agreement terms and contracts.

Acknowledgments

The work described in this study was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Utility Technologies, Office of Energy Management Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098. The authors would particularly like to thank Diane Pirkey at the U.S. Department of Energy for her support of this work. In addition, the authors are grateful for valuable comments received from Joe Eto (LBNL), Ed Kahn (NERA), Suzie Kito (MRW & Associates), Mike Lee (Montana Public Service Commission), and Ryan Wiser (LBNL).

Acronyms and Abbreviations

CFTC	Commodity Futures Trading Commission
COB	California-Oregon Border
CPUC	California Public Utilities Commission
ESP	Energy Service Provider
FAC	Fuel Adjustment Clause
FERC	Federal Energy Regulatory Commission
MG	Metallgesellschaft
NYMEX	New York Mercantile Exchange
ORA	Office of Ratepayer Advocates (California)
OTC	Over-the-counter
PBR	Performance Based Ratemaking
PG&E	Pacific Gas and Electric
PJM	Pennsylvania New Jersey Maryland Interconnection
PPAC	Purchased Power Adjustment Clause
PUC	Public Utility Commission
PX	Power Exchange
ROR	Rate-of-return
SCE	Southern California Edison
UDC	Utility Distribution Company
WSCC	Western States Coordinating Council

Glossary

Backwardation	A market experiences backwardation if the spot price exceeds the futures price.
Basis	The spot price of a commodity minus the futures price that is being used to hedge that commodity at any given time.
Basis risk	The risk caused by any possibility that the futures price will not converge to the spot price of the commodity being hedged at maturity.
Cash position	Amount of underlying commodity owned.
Close out	To sell a future you are long in or buy a future you are short in.
Contango	A market is in contango if the futures price exceeds the spot price.
Derivative	A financial product whose value is based on (derived from) another product.
Forward	A contract to deliver goods at some future date at some fixed price.
Future	A standardized forward that can be traded on an exchange.
Hedging	Buying a derivative to offset the risk of a cash position.
Option	When a firm buys an option, it has the right, but not the obligation, to purchase or sell the underlying commodity.
Settlement	To take or make delivery at maturity. Physical commodity futures usually require commodity settlement, financial futures usually require cash settlement.
Speculation	Buying a derivative that increases your risk with the hope of profiting.
Swaps	Swaps provide similar risk management opportunities as futures, but never result in delivery.
Variation margin	Daily payments from losers to gainers.

CHAPTER 1

Introduction

1.1 What Is Hedging?

Increased competition in bulk power and retail electricity markets is likely to lower electricity prices, but will also result in greater price volatility as the industry moves away from administratively determined, cost-based rates and towards market-driven prices.[2] Price volatility introduces new risks for generators, consumers, and marketers. In a competitive environment, some generators will sell their power in potentially volatile spot markets and will be at risk if spot prices are insufficient to cover generation costs. Consumers will face greater seasonal, daily, and hourly price variability and, for commercial businesses, this uncertainty could make it more difficult to assess their long-term financial position. Finally, power marketers sell electricity to both wholesale and retail consumers, often at fixed prices. Marketers who buy on the spot market face the risk that the spot market price could substantially exceed fixed prices specified in contracts.

Electricity futures and other electric rate derivatives help electricity generators, consumers, and marketers manage, or hedge, price risks in a competitive electricity market. Futures contracts are legally binding and negotiable contracts that call for the future delivery of a commodity. In most cases, physical delivery does not take place, and the futures contract is closed by buying or selling a futures contract on or near the delivery date. Other electric rate derivatives include options, price swaps, basis swaps, and forward contracts. Futures and options are traded on an exchange where participants are required to post margins to cover potential losses. Other hedging instruments are traded bilaterally in the "over-the-counter" (OTC) market.[3]

The New York Mercantile Exchange (NYMEX) introduced electricity futures on March 29, 1996. While some futures contracts have failed due to lack of interest,[4] initial interest in electricity futures appears to be strong. In the 20 months since NYMEX introduced electricity futures, trading has grown to an average of 2,500 contracts per day, with over 113,000 contracts traded from January to August 1997, well in excess of the 45,000 contracts traded in all of 1996 (McGraw-Hill 1997, NYMEX 1997). Recent moves by NYMEX to issue cheaper electricity futures trading permits have been designed to further boost trading

2 The natural gas industry provides an illustrative example. Prior to deregulation, natural gas prices were relatively steady. Since deregulation, natural gas prices have been among the most volatile of any traded commodity (Enron Capital & Trade Resources 1996).

3 Many of the important futures and derivatives related terms are reviewed in the glossary at the end of this document.

4 Since the inception of future markets in the United States, over 128 commodities have been listed on at least one exchange. As of 1986, only 45 commodities were actively traded (Black 1986).

volume for the commodity, as have the introduction of new NYMEX electricity futures contracts with additional delivery points (Dow Jones 1997, McGraw-Hill 1997). Yet while growth in the trading of electricity futures has been strong, the market remains small compared to futures trading in other commodities. For example, natural gas futures, which were launched in 1990, were the fastest growing contracts in Exchange history with over nine million contracts traded in 1996, second only to crude oil contracts.[5]

Futures are not the only way to hedge electricity price risk, however, and NYMEX also offers electricity options contracts, which were introduced in April 1996. Elsewhere, OTC hedging instruments are widely used in natural gas and oil markets and are beginning to be used in electricity markets. While no official data is available on the volume of these OTC transactions, this market may be as large or several times larger than the futures market.

1.2 Why Should Regulators Care?

Although derivatives offer the potential for managing commodity price risk in a competitive electricity market, their use will introduce new risks. Some speculators and hedgers have incurred substantial losses using futures and more complex derivative instruments. Metallgesellschaft (MG), an oil marketer, lost $1 billion dollars attempting to hedge a ten-year risk using a short term futures contract. Orange County lost $2.3 billion using derivatives in order to earn a higher return, a classic case of speculative losses.

When retail competition develops, state regulators may have an interest in protecting customers from the indirect consequences of potentially speculative derivative activities undertaken by marketers, generators, and other retail service providers (ORA 1997). To the extent regulated distribution utilities enter the derivatives market, state regulators will want to ensure that these transactions are in the best interest of retail customers.

Yet futures and derivatives should not be regulated simply because they can produce losses. Not using futures in volatile commodity markets can also produce losses. Instead, policies should be motivated by the effect the use of futures will have on the objectives of utility regulation. The traditional goal of utility regulation has been to ensure that consumers have a reliable supply of electricity that can be purchased at a fair price. This raises the issue of whether large futures losses by firms that play a vital role in maintaining the reliability of the electricity grid could increase the likelihood of a costly electrical outage.

In some situations, state regulators may need to monitor or set limits on derivatives transactions undertaken by utilities because of market power concerns during the transition to competitive electricity markets (ORA 1997, CPUC 1997a). Some parties have argued that,

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5 Trading in natural gas futures set a daily volume record of 99,866 contracts on April 23, 1997—the third highest daily trading volume in the history of energy trading at NYMEX (NYMEX 1997).

in states such as California where large distribution utilities are required to sell into a power pool or exchange (PX), they may have incentives to manipulate PX prices in order to reap returns on positions taken in futures and other derivatives contracts. A related concern is that, where futures contracts are settled through delivery—a rare event, as we discuss, but one that nonetheless can and does occur—the distribution utility may be required to buy or sell electricity outside the PX, a sale that would violate their requirement to sell only to the PX (CPUC 1997a, 1997b).[6]

1.3 Purpose and Organization of this Report

This report is intended as a primer for public utility commissioners and their staff on futures and other financial instruments being used by market participants to manage price risks in competitive electricity markets. A primary goal is to contribute to the discussion already underway on both the benefits and risks posed by electricity futures and other derivatives. At a minimum, we hope to discourage regulators who may be tempted to take an "easy way out" on this very important issue. One such easy way out might be to simply ban the use of derivatives by regulated utilities because they are not well understood or are seen as too risky. Such a policy would prevent a great deal of socially beneficial hedging. Alternatively, regulators could ignore derivatives until they become a more serious concern. This second path could lead to a situation where regulators are surprised by an Orange County-type financial disaster that significantly impacts ratepayers.

The report is organized as follows:

- In Chapter 2, we explain why a competitive electricity market needs derivatives.
- In Chapter 3, we focus on futures, explain the rationale for using futures and present the "fundamentals" of hedging price risks using futures contracts.
- In Chapter 4, we explain how other electric rate derivatives work, how they can be used by generators, end users, and marketers, and we discuss the risks associated with these instruments.
- Finally, in Chapter 5, we discuss regulatory issues, including the risks primarily associated with futures, but peripherally with other electric rate derivatives, and we highlight potential regulatory policies to address these risks.

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6 An additional potential question for regulators is whether electricity markets should be structured in a way that supports the development of derivative markets. Although this is an important question, we focus here on other issues that have received considerably less attention by researchers and policy advocates. See Levin (1995) for a discussion of derivatives and electric industry structure.

CHAPTER 2

Price Volatility and Risk in Competitive Electricity Markets

As the U.S. moves towards competitive electricity markets, the expectation is that electricity prices will be lower overall but price volatility will increase. In this section, we describe the link between competition and price volatility, and explain why price volatility will result in new risks for generators, marketers, and end users. Futures and other derivatives can help manage these risks but also introduce risks of their own.

2.1 Determinants of Price Volatility

One can look to the natural gas market to get an indication of the potential price volatility in electricity. Like electricity generation, the wellhead price of natural gas used to be subject to price regulation and was, therefore, quite stable. With deregulation, the price of natural gas decreased but became more volatile. Gas price volatility is driven largely by sensitivity to weather-induced seasonal demand. Electricity is also characterized by seasonal demand and its price can be quite volatile, as illustrated in Figure 2-1.

A traditional and explicit goal of utility regulation has been to stabilize retail prices, even though the underlying costs of producing electricity are quite volatile. Bonbright (1961), in his classic text on rate design, gives two reasons for stable rates. First, regulatory proceedings are “notoriously expensive and cumbersome,” making it impractical to frequently change rates. Second, Bonbright argues that consumers need to see prices that reflect long-run costs so that they can make intelligent purchasing decisions for items that use energy. Yet while price stability may promote rational consumer decisions regarding energy using equipment and has a small benefit in reducing consumer risk, it also causes a significant inefficiency in the electricity market by making it impossible for customers to respond to the true cost of electricity. Schnitzer (1995) estimates that peak power costs may approach 50¢/kWh, but because of utility rate designs, consumers treat power even at these times as if it cost only 10¢/kWh. Consequently, customers significantly over-consume during peak hours. However, consumers do pay for these costs during off-peak hours when power is overpriced, in many places by a factor of two or three. At these times, the distortion is towards under-consumption.